

# Chinguetti- Terrestrial Age and Pre-Atmospheric Size

*K.C. Welten, P.A. Bland, M.W. Caffee, J. Masarik, S.S.  
Russell, I. Denyer, J. Lloyd and M.M. Grady*

*This article was submitted to  
31<sup>st</sup> Lunar and Planetary Science Conference  
Houston, TX  
March 13-17, 2000*

**January 14, 2000**

**U.S. Department of Energy**

Lawrence  
Livermore  
National  
Laboratory

## DISCLAIMER

This document was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor the University of California nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or the University of California, and shall not be used for advertising or product endorsement purposes.

This is a preprint of a paper intended for publication in a journal or proceedings. Since changes may be made before publication, this preprint is made available with the understanding that it will not be cited or reproduced without the permission of the author.

This report has been reproduced  
directly from the best available copy.

Available to DOE and DOE contractors from the  
Office of Scientific and Technical Information  
P.O. Box 62, Oak Ridge, TN 37831  
Prices available from (423) 576-8401  
<http://apollo.osti.gov/bridge/>

Available to the public from the  
National Technical Information Service  
U.S. Department of Commerce  
5285 Port Royal Rd.,  
Springfield, VA 22161  
<http://www.ntis.gov/>

OR

Lawrence Livermore National Laboratory  
Technical Information Department's Digital Library  
<http://www.llnl.gov/tid/Library.html>

**CHINGUETTI - TERRESTRIAL AGE AND PRE-ATMOSPHERIC SIZE.** K.C. Welten<sup>1</sup>, P.A. Bland<sup>2</sup>, M. W. Caffee<sup>3</sup>, J. Masarik<sup>1</sup>, S.S. Russell<sup>2</sup>, I. Denyer<sup>5</sup>, J. Lloyd<sup>6</sup> and M.M. GRADY<sup>2</sup>, <sup>1</sup>Space Sciences Laboratory, University of California, Berkeley, CA 94720-7450, USA; <sup>2</sup>Department of Mineralogy, Natural History Museum, Cromwell Road, London SW7 5BD; <sup>3</sup>CAMS, Lawrence Livermore National Laboratory, Livermore, CA 94551, USA;; <sup>5</sup>I Denyer, 5 Statham Grove, Stoke Newington, London N16 9DP; <sup>6</sup>Flat 2, 60 Brixton Road, London SW9 6BS.

**Introduction.** Chinguetti is a 4.5 kg mesosiderite find recovered from the Adra region of Mauretania, some 45 km from the oasis town of Chinguetti, in 1916. It was, however, several years before the sample was identified as a meteorite. When it was, and the description of the find was released in 1924, it generated considerable excitement. Gaston Ripert, the French officer who found the meteorite, maintained that it was a representative sample of a much larger mass. His description, as transcribed by Lacroix (1924), states: "It was lying on top of an enormous metallic mass measuring about 100m on one side and about 40m in height, which stands up in the middle of the dunes..." Ripert's position as a French officer, and his comparative lack of interest in the find (he turned the sample over to M.H. Hubert, a friend and a Doctor of Science in Dakar, and in the intervening years between the find and the announcement in 1924, made no effort to follow up on any progress made in its analysis, and in fact never claimed that it was a meteorite) convinced many that his story was true. Numerous expeditions have attempted to find the larger mass, and several explanations offered to explain their failure: the find location being somewhat uncertain, possibly dunes had partially or completely covered the mass; Ripert may have mistaken desert varnished sandstone for a large metallic mass, and just happened by chance on the smaller sample; or, for his own reasons, he simply lied. To elucidate this problem, we chose to analyse a portion of the recovered sample for cosmogenic radionuclides, to determine its terrestrial age, and its pre-atmospheric radius.

**Experimental Procedures.** We analyzed a chip taken about 5 cm from the fusion crust. We separated both metal and stone fraction. After adding carrier, containing Be, Al, Cl and Ca, the metal and stone fractions were dissolved in 1.5N HNO<sub>3</sub> and concentrated HF/HNO<sub>3</sub>, respectively. The Be, Al and Cl were separated and <sup>10</sup>Be, and <sup>36</sup>Cl concentrations were determined using the LLNL-AMS facility (Davis et al., 1990).

**Results and discussion.** The <sup>10</sup>Be and <sup>36</sup>Cl results are shown in Table 1, whereas the <sup>26</sup>Al measurements are still in progress.

Table 1. Cosmogenic radionuclide concentrations in Chinguetti mesosiderite.

	Conc. (dpm/kg)*
<sup>10</sup> Be(stone)	21.2 ± 0.3
<sup>10</sup> Be(metal)	3.35 ± 0.05
<sup>36</sup> Cl(metal)	17.4 ± 0.2

\* 1σ-errors include all known AMS errors, but not the uncertainties in the AMS standards

Although the cosmic-ray exposure age of Chinguetti is unknown, the saturation activity level of <sup>10</sup>Be in stone phase suggests that the exposure age of the meteorite is more than 5 My. Mesosiderites typically have exposure ages 10-300 My [5]. The <sup>36</sup>Cl-<sup>10</sup>Be terrestrial age method [6] yields a terrestrial age <30 ky. Measurements of <sup>41</sup>Ca in the metal phase and <sup>14</sup>C in the stone phase will further constrain the terrestrial age of Chinguetti.

**Pre-atmospheric size.** The low concentration of <sup>36</sup>Cl and <sup>10</sup>Be in the metal phase relative to the saturation activities of those nuclides in meteorites of typical size

suggests that Chinguetti was exposed to energetic particles while moderately shielded. According to Monte-Carlo based calculations for the production rates of  $^{10}\text{Be}$  and  $^{36}\text{Cl}$ , we can constrain the pre-atmospheric radius to 50-80 cm and the shielding depths of 15-25 cm

**Conclusions.** These data indicate that Chinguetti is a comparatively recent fall, at least, too recent to be consistent with Ripert's original description of the main mass having a heavily wind eroded base. More compelling is our estimate of a pre-atmospheric radius of <1m, suggesting that Ripert was either mistaken, or for some reason falsified his description of the find.

**Acknowledgments.** This work was supported by NASA grant NAG5-4992, and was performed under the auspices of the U.S. DOE by LLNL under contract W-7405-ENG-48.

**References:** [1] Lacroix A. (1924) Comptes Rendus 179, 303-313. [2] Welten et al. (1999) NIPR Ant. Met. Res. 12, 94-107. [3] Davis J. C. (1990) Nucl. Inst. Meth. B52, 269-272. [4] Lavielle B. et al. (1999) EPSL 170, 93-104. [5] Terribilini D. et al. (2000), submitted to MAPS. [6] Nishiizumi K. et al. (1997) MAPS 32, A100. [7] Welten K.C. et al. (1999) MAPS 34, A121-122.